

REMARKS

Claims 90 and 93-141 are pending in this application. Claims 90 and 108 have been amended. Claims 91 and 92 have been canceled. New claims 122-141 have been added to round out the scope of protection afforded the present invention. No new matter has been introduced. The title of the invention has been amended to more clearly describe the subject matter of the claimed invention.

Claims 90, 93-101 and 104-119 stand rejected under 35 U.S.C. §102(b) as being anticipated by Rhodes (U.S. Patent No. 6,204,524) ("Rhodes"). This rejection is respectfully traversed.

The claimed invention relates to a method of forming a CMOS imager with improved charge storage. As such, amended independent claim 90 recites a "method of forming a CMOS imager" by *inter alia* "providing a semiconductor substrate having a doped layer of a first conductivity type" and "forming a first doped region of a second conductivity type in said doped layer, said first doped region being adjacent a field oxide region." Amended independent claim 90 also recites "forming a charge storage capacitor such that the entire extent of said charge storage capacitor overlies said field oxide region" and "forming a contact between said first doped region and said charge storage capacitor."

Independent claim 108 recites a "method of forming a CMOS imager" by *inter alia* "providing a semiconductor substrate having a doped layer of a first conductivity type," "forming a field oxide region within said semiconductor substrate" and "forming a first conductive layer over said field oxide region and said substrate." Independent claim 108 also recites "forming an insulating layer over said first conductive layer," "forming a second conductive layer over said insulating layer" and "patterning said first conductive layer, said insulating layer and said second conductive

layer to form a storage capacitor and an electrical element of said CMOS imager, wherein the entire extent of said storage capacitor is formed over and in contact with said field oxide region."

Rhodes relates to a CMOS imager that "provides improved charge storage by fabricating a storage capacitor in parallel with the photocollection area of the imager." (Abstract). According to Rhodes, "[t]he storage capacitor may be a flat plate capacitor formed over the pixel, a stacked capacitor or a trench imager formed in the photosensor." (Abstract).

Rhodes fails to disclose all limitations of claims 90, 93-101 and 104-119. Rhodes does not disclose, teach or suggest "forming a charge storage capacitor such that *the entire extent of said charge storage capacitor overlies said field oxide region*" and "forming a contact between said first doped region and said charge storage capacitor," as amended independent claim 90 recites (emphasis added). Rhodes is also silent about "patterning said first conductive layer, said insulating layer and said second conductive layer to form a storage capacitor and an electrical element of said CMOS imager, wherein *the entire extent of said storage capacitor is formed over and in contact with said field oxide region,*" as independent claim 108 recites (emphasis added).

Applicants submit that, as described and illustrated in all figures of Rhodes, the trench and planar capacitor structures of Rhodes are all formed overlying the active area of the pixel sensor cell, and not such that "the entire extent of said charge storage capacitor overlies said field oxide region" (claim 90) or "is formed over and in contact with said field oxide region" (claim 108). Applicants also note that the Abstract of Rhodes clearly specifies that "[t]he storage capacitor may be a flat plate capacitor *formed over the pixel*, a stacked capacitor or a trench imager formed in the photosensor" (emphasis added), and not a capacitor the entire extent of which "overlies said field

oxide region" or "is formed over and in contact with said field oxide region," as in the claimed invention. Applicants also note that Figure 5 of Rhodes clearly shows parts of electrodes 156 and 160 of the capacitor 162 formed over the doped region 155 and the photogate 102 of the transistor 125 of Rhodes. Thus, storage capacitor 162 of Rhodes is not illustrated in Figure 5 as "overl[ying] said field oxide region" or "formed over and in contact with said field oxide region," as in the claimed invention.

For at least the reasons above, Rhodes fails to anticipate the subject matter of claims 90, 93-101 and 104-119. Withdrawal of the rejection of these claims is respectfully requested.

Claims 102, 103, 120 and 121 stand rejected under 35 U.S.C. §103 as being unpatentable over Rhodes. This rejection is respectfully traversed.

Claims 102 and 103 depend on amended independent claim 90 and recite that the gate is "a gate of a global shutter transistor." Claims 120 and 121 depend on independent claim 108 and recite that the electrical element is "a gate of a global shutter transistor." As noted above, Rhodes fails to disclose, teach or suggest all limitations of independent claims 90 and 108. Accordingly, and for at least these reasons, the Office Action fails to establish a *prima facie* case of obviousness, and withdrawal of the rejection of claims 102, 103, 120 and 121 is also respectfully requested.

New claims 122-141 have been added to round out the scope of protection afforded by the present invention. Newly added independent claim 122 recites a "method of forming an imager" by *inter alia* "forming a photosensor including a charge collection region," "forming a floating diffusion region for receiving charge from said charge collection region" and "forming a charge storage capacitor . . . so that one electrode of said storage capacitor is connected to said floating diffusion region by an

electrical contact.” Newly added independent claim 130 recites a “method of forming an imager” by *inter alia* “forming a field oxide region in said semiconductor substrate,” “forming a photodiode in said doped layer” and “forming a charge storage capacitor such that the entire extent of said charge storage capacitor overlies said field oxide region.” Newly added independent claim 130 also recites “connecting an electrode of a charge storage capacitor to said photodiode by an electrical contact.”

Newly added independent claim 137 recites a “method of forming an imager” by *inter alia* “forming a photosensor including a charge collection region,” “forming a floating diffusion region for receiving charge from said charge collection region” and “connecting an electrode of a first charge storage capacitor to said floating diffusion region by a first electrical contact.” Newly added independent claim 137 further recites “connecting an electrode of a second charge storage capacitor to said charge collection region by a second electrical contact.”

Applicants submit that Rhodes fails to disclose, teach or suggest the subject matter of newly added claims 122-141. In addition, the prior art references cited in the last Office Action dated July 9, 2004 fail to disclose, teach or suggest the subject matter of newly added claims 122-141, whether considered alone or in combination.


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Allowance of claims 90 and 93-141 is solicited.

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